UNIT INFORMATION

Corp. 0528-L10
Revised 05-2008

XP13

XP13 SERIES UNITS

The XP13 is a high efficiency residential split-system heat pump unit, which features a scroll compressor and R-410A refrigerant. XP13 units are available in sizes ranging from 1 1/2 through 5 tons. The series is designed for use with an indoor unit with an expansion valve approved for R-410A. This manual is divided into sections which discuss the major components, refrigerant system, charging procedure, maintenance and operation sequence.
Information contained in this manual is intended for use by qualified service technicians only. All specifications are subject to change.

⚠ IMPORTANT

Operating pressures of this R-410A unit are higher than pressures in R-22 units. Always use service equipment rated for R-410A.

⚠ WARNING

Warranty will be voided if covered equipment is removed from original installation site. Warranty will not cover damage or defect resulting from: Flood, wind, lightning, or installation and operation in a corrosive atmosphere (chlorine, fluorine, salt, recycled waste water, urine, fertilizers, or other damaging chemicals).

⚠ WARNING

Improper installation, adjustment, alteration, service or maintenance can cause property damage, personal injury or loss of life. Installation and service must be performed by a qualified installer or service agency.

⚠ WARNING

Electric shock hazard. Can cause injury or death. Before attempting to perform any service or maintenance, turn the electrical power to unit OFF at disconnect switch(es). Unit may have multiple power supplies.

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SPECIFICATIONS

General Data	Model No.	XP13-018	XP13-024	XP13-030	XP13-036	XP13-037	XP13-042	XP13-048	XP13-060
	Nominal Tonnage	1.5	2	2.5	3	3+	3.5	4	5
Connections (sweat)	Liquid line (o.d.) - in.	3/8	3/8	3/8	3/8	3/8	3/8	3/8	3/8
	Vapor line (o.d.)	3/4	3/4	3/4	3/4	3/4	7/8	7/8	1-1/8
Refrigerant	[1] R-410A charge furnished	8 lbs. 15 oz.	7 lbs. 7 oz.	7 lbs. 10 oz.	10 lbs. 2 oz.	10 lbs. 3 oz.	11 lbs. 10 oz.	11 lbs. 10 oz.	15 lbs. 0 oz.
Outdoor Coil	Net face area sq. ft. Outer coil	13.22	13.22	13.22	15.11	18.67	18.67	18.67	24.50
	Net face area sq. ft. Inner coil	12.65	12.65	12.65	14.46	18.00	18.00	18.00	23.64
	Tube diameter - in.	5/16	5/16	5/16	5/16	5/16	5/16	5/16	5/16
	No. of Rows	2	2	2	2	2	2	2	2
	Fins per inch	22	22	22	22	22	22	22	22
Outdoor Fan	Diameter - in.	18	18	18	18	22	22	22	22
	No. of blades	3	3	3	3	4	4	4	4
	Motor hp	1/10	1/10	1/10	1/10	1/6	1/6	1/4	1/4
	Cfm	2215	2215	2270	2330	3150	3150	3730	3980
	Rpm	1040	1040	1050	1060	844	844	824	836
	Watts	145	145	165	170	215	215	320	305
Shipping Data - lbs. 1 pkg.		189	188	192	208	235	260	267	305
ELECTRICAL DATA									
	Line voltage data - 60hz - 1 phase	208/230V	208/230V	208/230V	208/230V	208/230V	208/230V	208/230V	208/230V
	[3] Maximum overcurrent protection (amps)	20	30	30	35	35	40	50	60
	[2] Minimum circuit ampacity	11.9	17.5	18.4	21.6	21.9	23.2	28.9	34.6
Compressor	Rated load amps	8.97	13.46	14.1	16.67	16.67	17.69	21.79	26.28
	Locked rotor amps	48	58	73	79	79	107	117	134
	Power factor	0.98	0.98	0.98	0.99	0.99	0.99	0.99	0.99
Outdoor Fan Motor	Full load amps	0.7	0.7	0.7	0.7	1.1	1.1	1.7	1.7
	Locked Rotor Amps	1.4	1.4	1.4	1.4	2.1	2.1	2.1	3.1
OPTIONAL ACCESSORIES - must be ordered extra									
Compressor Hard Start Kit	**10J42**	•							
	88M91		•	•	•	•	•	•	•
Compressor Crankcase Heater	**93M04**	•	•	•	•	Factory			
Compressor Low Ambient Cut-Off	**45F08**	•	•	•	•	•	•	•	•
Compressor Sound Cover	**69J03**	•	•	•	•	•	•	•	•
Freezestat 3/8 in. tubing	**93G35**	•	•	•	•	•	•	•	•
5/8 in. tubing	**50A93**	•	•	•	•	•	•	•	•
Low Ambient Kit	**54M89**	•	•	•	•	•	•	•	•
Low Pressure Switch Bypass Thermostat	**13W07**	•	•	•	•	•	•	•	•
Mild Weather Kit	**33M07**	•	•	•	•	•	•	•	•
Monitor Kit - Service Light	**76F53**	•	•	•	•	•	•	•	•
Outdoor Thermostat Kit Thermostat	**56A87**	•	•	•	•	•	•	•	•
Mounting Box	**31461**	•	•	•	•	•	•	•	•
Refrigerant Line Sets L15-41-20 L15-41-30	L15-41-40 L15-41-50	•	•	•	•	•			
L15-65-30	L15-65-40 L15-65-50						•	•	
	Field Fabricate								•
Time Delay Relay	**58M81**	•	•	•	•	•	•	•	•

NOTE - Extremes of operating range are plus 10% and minus 5% of line voltage.
[1] Refrigerant charge sufficient for 15 ft. length of refrigerant lines.
[2] Refer to National or Canadian Electrical Code manual to determine wire, fuse and disconnect size requirements.
[3] HACR type breaker or fuse.

I - UNIT INFORMATION

ELECTROSTATIC DISCHARGE (ESD)
Precautions and Procedures

CAUTION

Electrostatic discharge can affect electronic components. Take precautions during unit installation and service to protect the unit's electronic controls. Precautions will help to avoid control exposure to electrostatic discharge by putting the unit, the control and the technician at the same electrostatic potential. Neutralize electrostatic charge by touching hand and all tools on an unpainted unit surface before performing any service procedure.

All major components (indoor blower and coil) must be matched according to Lennox recommendations for the compressor to be covered under warranty. Refer to the Engineering Handbook for approved system matchups. A misapplied system will cause erratic operation and can result in early compressor failure.

IMPORTANT

This unit must be matched with an indoor coil as specified in Lennox' Engineering Handbook.

II - UNIT COMPONENTS

Unit components are illustrated in figure 1.

XP13 UNIT COMPONENTS

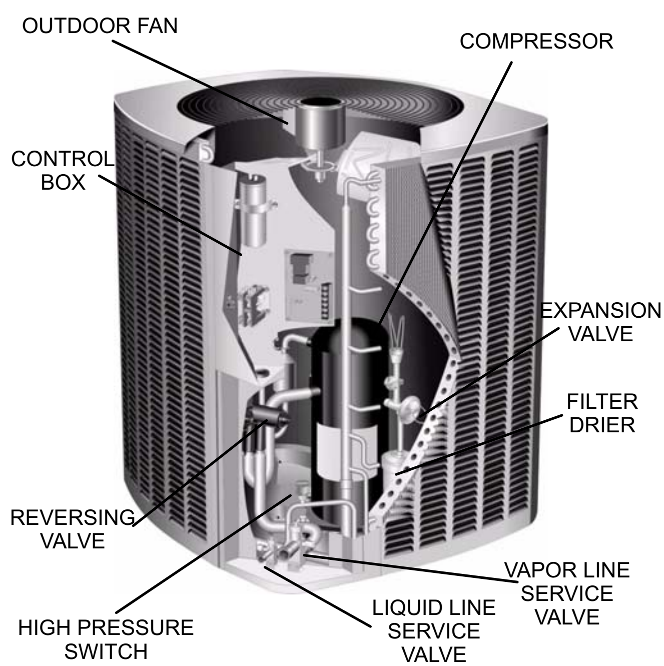


FIGURE 1

A - Control Box (Figure 2)

XP13 units are not equipped with a 24V transformer. All 24 VAC controls are powered by the indoor unit. Refer to wiring diagram.

SINGLE PHASE UNIT CONTROL BOX

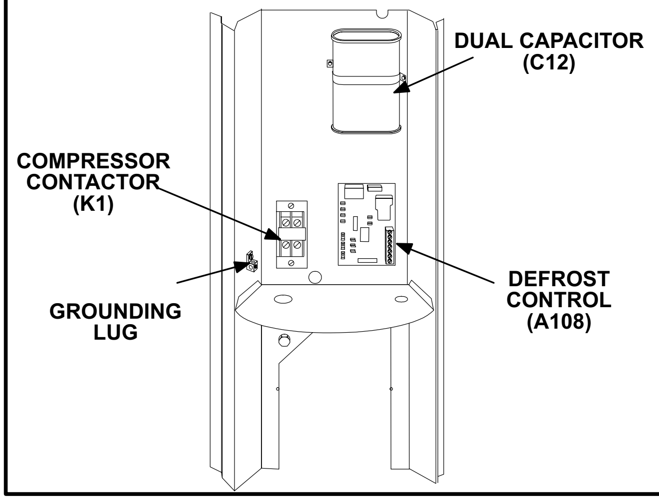


FIGURE 2

Electrical openings are provided under the control box cover. Field thermostat wiring is made to a 24V terminal strip located on the defrost control board located in the control box. See figure 3.

24V THERMOSTAT TERMINAL STRIP

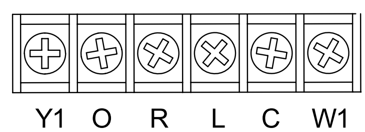
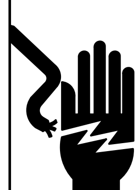


FIGURE 3

1 - Compressor Contactor K1

The compressor is energized by a contactor located in the control box. See figure 2. Single-pole contactors are used in all XP13 series units. K1 is energized through the control board by the indoor thermostat terminal Y1 (24V) when thermostat demand is present.

DANGER



Electric Shock Hazard.
May cause injury or death.
Line voltage is present at all components when unit is not in operation on units with single pole contactors.
Disconnect all remote electrical power supplies before opening unit panel.
Unit may have multiple power supplies.

2 - Dual Capacitor C12

The compressor and fan in XP13 series units use permanent split capacitor motors. The capacitor is located inside the unit control box (see figure 2). A single “dual” capacitor (C12) is used for both the fan motor and the compressor (see unit wiring diagram). The fan side and the compressor side of the capacitor have different MFD ratings. See side of capacitor for ratings.

3 - Defrost Control

The XP13 defrost system includes two components: a defrost thermostat and a defrost control.

Defrost Thermostat (Defrost Switch S6)

The defrost thermostat is located on the liquid line between the check/expansion valve and the distributor. When defrost thermostat senses 42°F (5.5°C) or cooler, the thermostat contacts close and send a signal to the defrost control board to start the defrost timing. It also terminates defrost when the liquid line warms up to 70°F (21°C).

Defrost Control

The defrost control board includes the combined functions of a time/temperature defrost control, defrost relay, diagnostic LEDs and terminal strip for field wiring connections.

The control provides automatic switching from normal heating operation to defrost mode and back. During compressor cycle (call for defrost), the control accumulates compressor run times at 30-, 60-, or 90-minute field-adjustable intervals. If the defrost thermostat is closed when the selected compressor run time interval ends, the defrost relay is energized and defrost begins.

XP13 Outdoor Unit Defrost Control Board

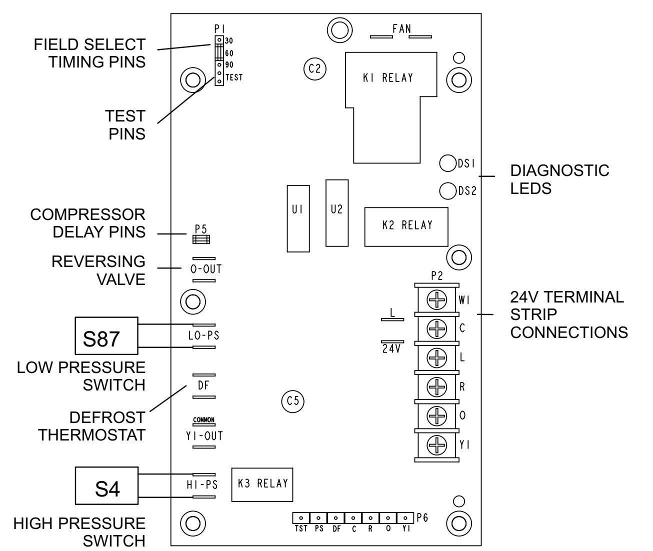


FIGURE 4

Defrost Control Timing Pins

Each timing pin selection provides a different accumulated compressor run time period for one defrost cycle. This time period must occur before a defrost cycle is initiated. The defrost interval can be adjusted to 30, 60 or 90 minutes (see figure 4). The defrost timing jumper is factory-installed to provide a 60-minute defrost interval. If the timing selector jumper is not in place, the control defaults to a 90-minute defrost interval. The maximum defrost period is 14 minutes and cannot be adjusted.

A TEST option is provided for troubleshooting. **The TEST mode may be started any time the unit is in the heating mode and the defrost thermostat is closed or jumpered.** If the jumper is in the TEST position at power-up, the control will ignore the test pins. When the jumper is placed across the TEST pins for two seconds, the control will enter the defrost mode. If the jumper is removed before an additional 5-second period has elapsed (7 seconds total), the unit will remain in defrost mode until the defrost thermostat opens or 14 minutes have passed. If the jumper is not removed until after the additional 5-second period has elapsed, the defrost will terminate and the test option will not function again until the jumper is removed and re-applied.

Compressor Delay

The defrost board has a field-selectable function to reduce occasional sounds that may occur while the unit is cycling in and out of the defrost mode. The compressor will be cycled off for 30 seconds going in and out of the defrost mode when the compressor delay jumper is removed.

NOTE - The 30-second compressor feature is ignored when the defrost test pins are jumpered.

Time Delay

The timed-off delay is five minutes long. The delay helps to protect the compressor from short-cycling in case the power to the unit is interrupted or a pressure switch opens. The delay is bypassed by placing the timer select jumper across the TEST pins for 0.5 seconds.

Pressure Switch Circuit

The defrost control incorporates two pressure switch circuits. The high pressure switch (S4) is factory-connected to the board’s HI PS terminals (see figure 4). The board also includes a low pressure, or loss-of-charge-pressure, switch (S87). Switches are shown in the unit wiring diagram. During a single demand cycle, the defrost control will lock out the unit after the fifth time that the circuit is interrupted by any pressure switch wired to the control board. In addition, the diagnostic LEDs will indicate a locked-out pressure switch after the fifth occurrence of an open pressure switch (see Table 1). The unit will remain locked out until power to the board is interrupted, then re-established or until the jumper is applied to the TEST pins for 0.5 seconds.

Some XP13 units will be equipped with an optional by-pass switch wired in parallel with the low pressure switch (S87). This by-pass switch prevents nuisance trips when ambient conditions drop below 15° F.

NOTE - The defrost control board ignores input from the low-pressure switch terminals as follows:

during the TEST mode,

during the defrost cycle,

during the 90-second start-up period,

and for the first 90 seconds each time the reversing valve switches heat/cool modes.

Diagnostic LEDs

The defrost board uses two LEDs for diagnostics. The LEDs flash a specific sequence according to the condition.

TABLE 1

Defrost Control Board Diagnostic LED		
Mode	**Green LED (DS2)**	**Red LED (DS1)**
No power to control	OFF	OFF
Normal operation / power to control	Simultaneous Slow FLASH	
Anti-short cycle lockout	Alternating Slow FLASH	
Low pressure switch fault	OFF	Slow FLASH
Low pressure switch lockout	OFF	ON
High pressure switch fault	Slow FLASH	OFF
High pressure switch lockout	ON	OFF

B - Compressor

The scroll compressors in all XP13 model units are designed for use with R-410A refrigerant and operation at high pressures. Compressors are shipped from the factory with 3MA (32MMMA) P.O.E. oil. See electrical section in this manual for compressor specifications.

The scroll compressor design is simple, efficient and requires few moving parts. A cutaway diagram of the scroll compressor is shown in figure 5. The scrolls are located in the top of the compressor can and the motor is located just below. The oil level is immediately below the motor.

The scroll is a simple compression concept centered around the unique spiral shape of the scroll and its inherent properties. Figure 6 shows the basic scroll form. Two identical scrolls are mated together forming concentric spiral shapes (figure 7). One scroll remains stationary, while the other is allowed to "orbit" (figure 8). Note that the orbiting scroll does not rotate or turn but merely orbits the stationary scroll.

SCROLL COMPRESSOR

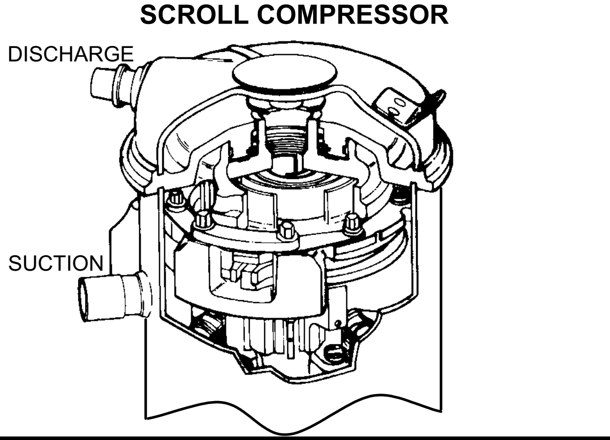


FIGURE 5

NOTE - During operation, the head of a scroll compressor may be hot since it is in constant contact with discharge gas.

SCROLL FORM

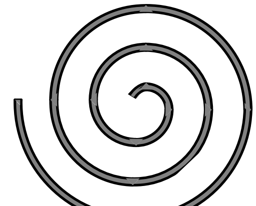


FIGURE 6

CROSS-SECTION OF SCROLLS

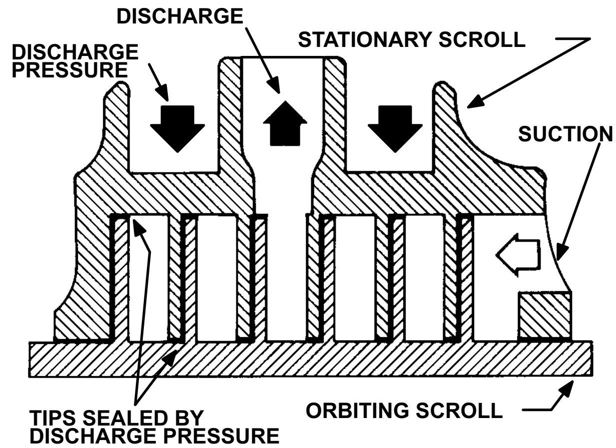


FIGURE 7

The counterclockwise orbiting scroll draws gas into the outer crescent shaped gas pocket created by the two scrolls (figure 8 - 1). The centrifugal action of the orbiting scroll seals off the flanks of the scrolls (figure 8 - 2). As the orbiting motion continues, the gas is forced toward the center of the scroll and the gas pocket becomes compressed (figure 8 - 3). When the compressed gas reaches the center, it is discharged vertically into a chamber and discharge port in the top of the compressor (figure 7). The discharge pressure forcing down on the top scroll helps seal off the upper and lower edges (tips) of the scrolls (figure 7). During a single orbit, several pockets of gas are compressed simultaneously providing smooth continuous compression.

The scroll compressor is tolerant to the effects of liquid return. If liquid enters the scrolls, the orbiting scroll is allowed to separate from the stationary scroll. The liquid is worked toward the center of the scroll and is discharged. If the compressor is replaced, conventional Lennox cleanup practices must be used.

Due to its efficiency, the scroll compressor is capable of drawing a much deeper vacuum than reciprocating compressors. Deep vacuum operation can cause internal fusite arcing resulting in damaged internal parts and will result in compressor failure. Never use a scroll compressor for evacuating or "pumping-down" the system. This type of damage can be detected and will result in denial of warranty claims.

The scroll compressor is quieter than a reciprocating compressor, however, the two compressors have much different sound characteristics. The sounds made by a scroll compressor do not affect system reliability, performance, or indicate damage.

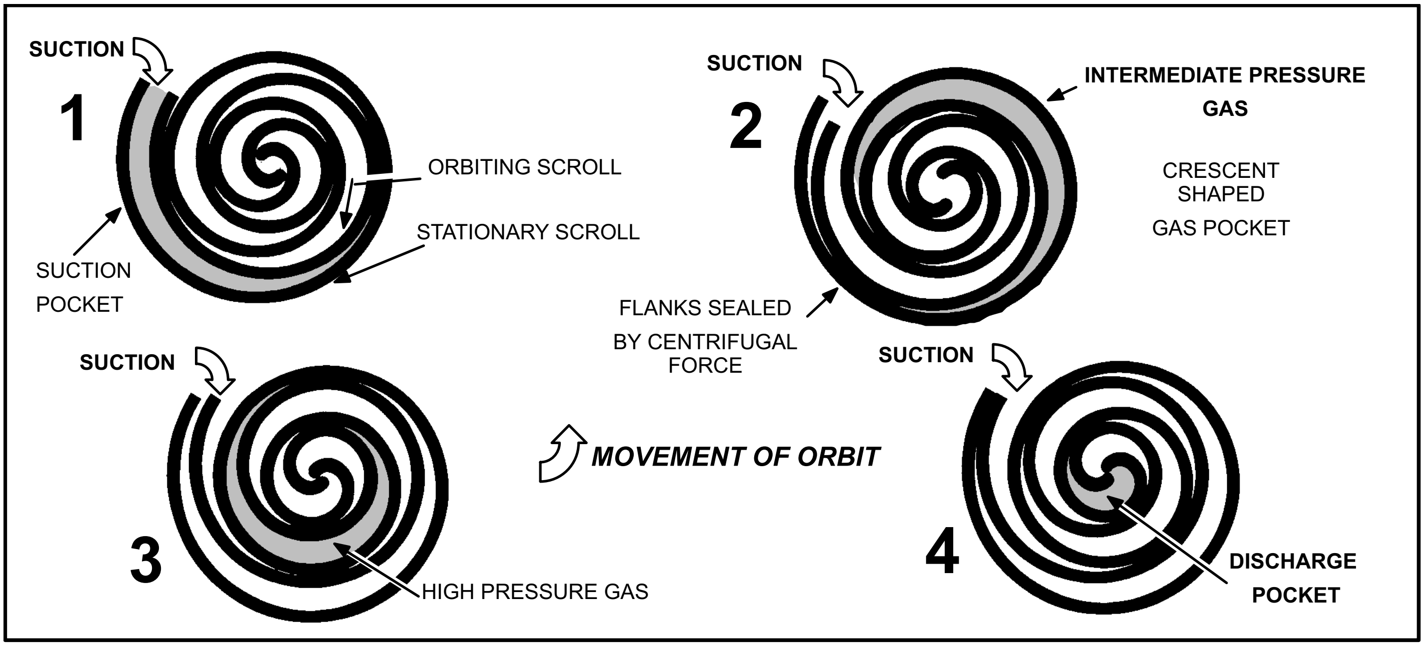


FIGURE 8

C - Outdoor Fan Motor

All units use single-phase PSC fan motors which require a run capacitor. In all units, the condenser fan is controlled by the compressor contactor.

ELECTRICAL DATA tables in this manual show specifications for condenser fans used in XP13's.

Access to the condenser fan motor on all units is gained by removing the four screws securing the fan assembly. See figure 9. The grill fan assembly can be removed from the cabinet as one piece. See figure 10. The condenser fan motor is removed from the fan guard by removing the four nuts found on top of the grill. See figure 10 if condenser fan motor replacement is necessary.

DANGER

Make sure all power is disconnected before beginning electrical service procedures.

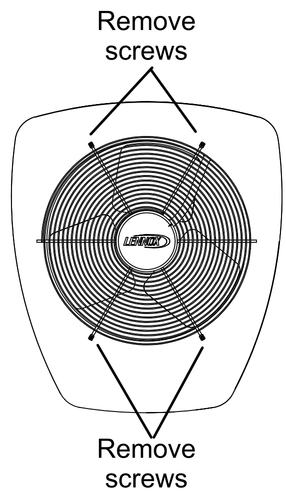


FIGURE 9

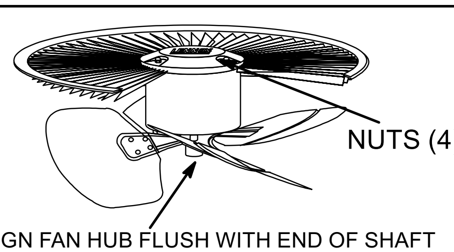


FIGURE 10

D - Reversing Valve L1 and Solenoid

A refrigerant reversing valve with electromechanical solenoid is used to reverse refrigerant flow during unit operation. The reversing valve requires no maintenance. It is not repairable. If the reversing valve has failed, it must be replaced.

E - Drier

A filter drier designed for all XP13 model units is factory installed in the liquid line. The filter drier is designed to remove moisture and foreign matter, which can lead to compressor failure.

Moisture and / or Acid Check

Because POE oils absorb moisture, the dryness of the system must be verified any time the refrigerant system is exposed to open air. A compressor oil sample must be taken to determine if excessive moisture has been introduced to the oil. Table 2 lists kits available from Lennox to check POE oils.

If oil sample taken from a system that has been exposed to open air does not test in the dry color range, the filter drier MUST be replace.

IMPORTANT

Replacement filter drier MUST be approved for R-410A refrigerant and POE application.

Foreign Matter Check

It is recommended that a liquid line filter drier be replaced when the pressure drop across the filter drier is greater than 4 psig. To safeguard against moisture entering the system follow the steps in section IV - sub section B - "Evacuating the System" when replacing the drier.

F - High/Low Pressure Switch

IMPORTANT

Pressure switch settings for R-410A refrigerant will be significantly higher than units with R-22.

An auto-reset, single-pole/single-throw high pressure switch is located in the liquid line. This switch shuts off the compressor when liquid line pressure rises above the factory setting. The switch is normally closed and is permanently adjusted to trip (open) at 590 $\pm$ 15 psi.

An auto-reset, single-pole/single-throw low pressure switch is located in the suction line. This switch shuts off the compressor when suction pressure drops below the factory setting. The switch is closed during normal operating pressure conditions and is permanently adjusted to trip (open) at 25 $\pm$ 5 psi. The switch automatically resets when suction line pressure rises above 40 $\pm$ 5 psi. Under certain conditions the low pressure switch is ignored. See *Pressure Switch Circuit* in the Defrost Control description.

G - Crankcase Heater

Crankcase heater prevents migration of liquid refrigerant into compressor and ensures proper compressor lubrication. The heaters are standard on the XP-037, -042, -048 and -060 and an option for all other models.

TABLE 2

KIT	CONTENTS	TUBE SHELF LIFE
10N46 - Refrigerant Analysis	Checkmate-RT700	
10N45 - Acid Test Tubes	Checkmate-RT750A (three pack)	2 - 3 years @ room temperature. 3+ years refrigerated
10N44 - Moisture Test Tubes	Checkmate - RT751 Tubes (three pack)	6 - 12 months @ room temperature. 2 years refrigerated
74N40 - Easy Oil Test Tubes	Checkmate - RT752C Tubes (three pack)	2 - 3 years @ room temperature. 3+ years refrigerated
74N39 - Acid Test Kit	Sporian One Shot - TA-1	

III - REFRIGERANT SYSTEM

Refer to figure 11 and 12 for refrigerant flow in the heating and cooling modes. The reversing valve is energized during cooling demand and during defrost.

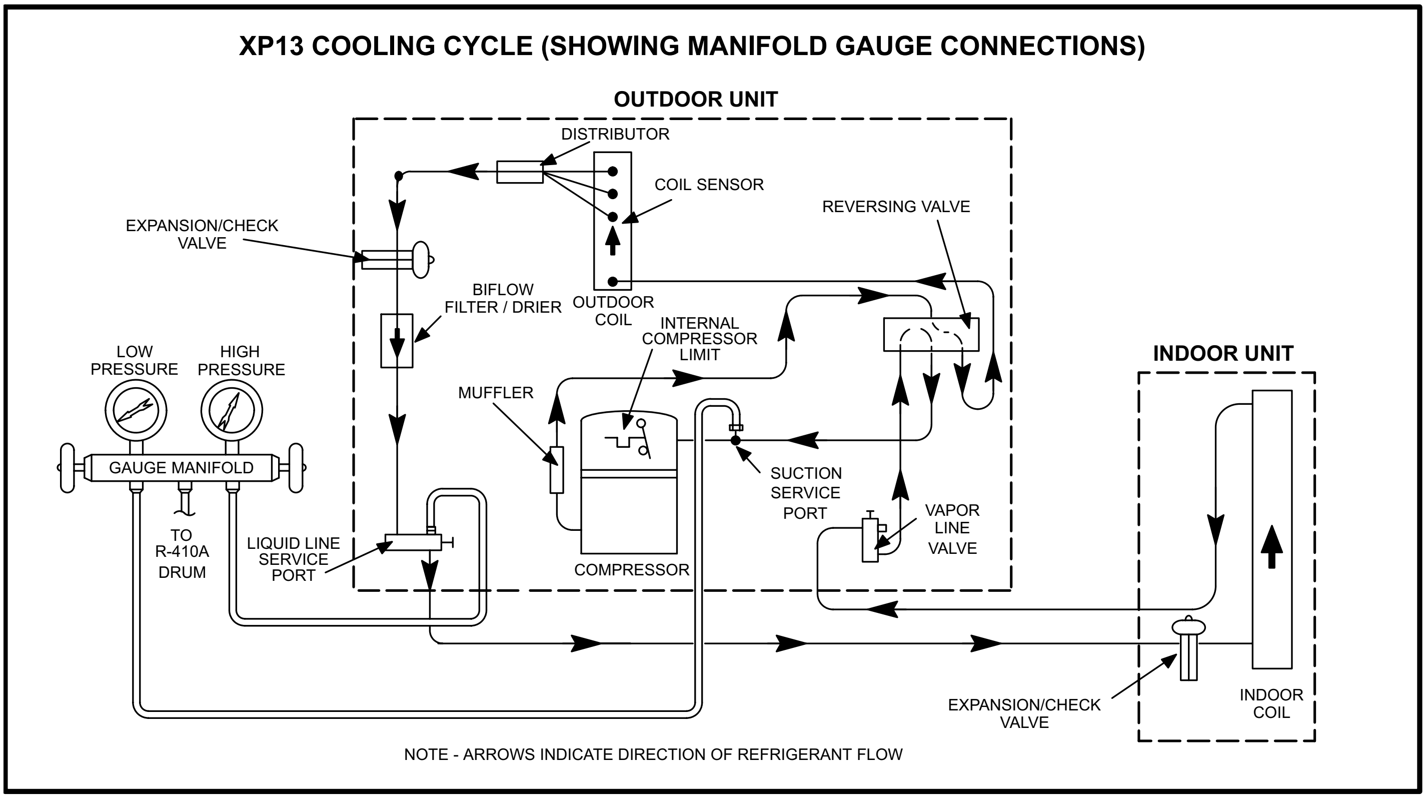


FIGURE 11

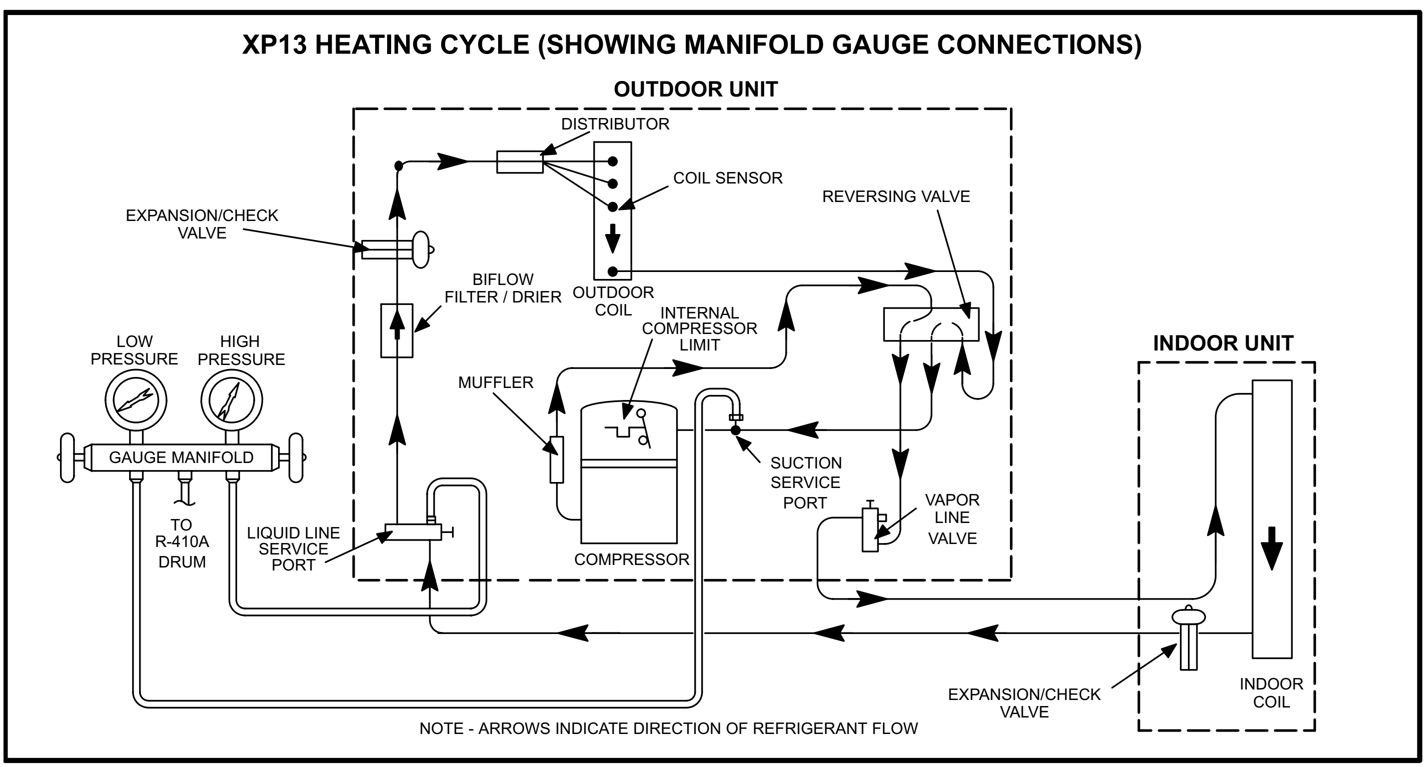


FIGURE 12

A - Plumbing

Field refrigerant piping consists of liquid and vapor lines from the outdoor unit (sweat connections). Use Lennox L15 (sweat) series line sets as shown in table 3.

TABLE 3

Refrigerant Line Sets					
Mod-el	Field Connections		Recommended Line Set		
	Liquid Line	Vapor Line	Liquid Line	Vapor Line	L15 Line Sets
-018 -024 -030 -036	3/8 in. (10 mm)	3/4 in (19 mm)	3/8 in. (10 mm)	3/4 in (19 mm)	L15-41 15 ft. - 50 ft. (4.6 m - 15 m)
-037 -042 -048	3/8 in. (10 mm)	7/8 in (22 mm)	3/8 in. (10 mm)	7/8 in (22 mm)	L15-65 15 ft. - 50 ft. (4.6 m - 15 m)
-060	3/8 in. (10 mm)	1-1/8 in. (29 mm)	3/8 in. (10 mm)	1-1/8 in. (29 mm)	Field Fabricated

B - Service Valves

IMPORTANT

Only use Allen wrenches of sufficient hardness (50Rc - Rockwell Harness Scale min). Fully insert the wrench into the valve stem recess. Service valve stems are factory torqued (from 9 ft lbs for small valves, to 25 ft lbs for large valves) to prevent refrigerant loss during shipping and handling. Using an Allen wrench rated at less than 50Rc risks rounding or breaking off the wrench, or stripping the valve stem recess.

Service valves (figures 13 and 14) and gauge ports are accessible from the outside of the unit. Use the service ports for leak testing, evacuating, charging and checking charge.

Each valve is equipped with a service port which has a factory-installed Schrader valve. A service port cap protects the Schrader valve from contamination and serves as the primary leak seal.

To Access Schrader Port:

1 - Remove service port cap with an adjustable wrench.

2 - Connect gauge to the service port.

3 - When testing is complete, replace service port cap. Tighten finger tight, then an additional 1/6 turn.

To Open Service Valve:

1 - Remove the stem cap with an adjustable wrench.

2 - Use a service wrench with a hex-head extension to back the stem out counterclockwise as far as it will go.

NOTE - Use a 3/16” hex head extension for 3/8” line sizes or a 5/16” extension for large line sizes.

3 - Replace the stem cap. Tighten finger tight, then tighten an additional 1/6 turn.

To Close Service Valve:

1 - Remove the stem cap with an adjustable wrench.

2 - Use a service wrench with a hex-head extension to turn the stem clockwise to seat the valve. Tighten the stem firmly.

NOTE - Use a 3/16” hex head extension for 3/8” line sizes or a 5/16” extension for large line sizes.

3 - Replace the stem cap. Tighten finger tight, then tighten an additional 1/6 turn.

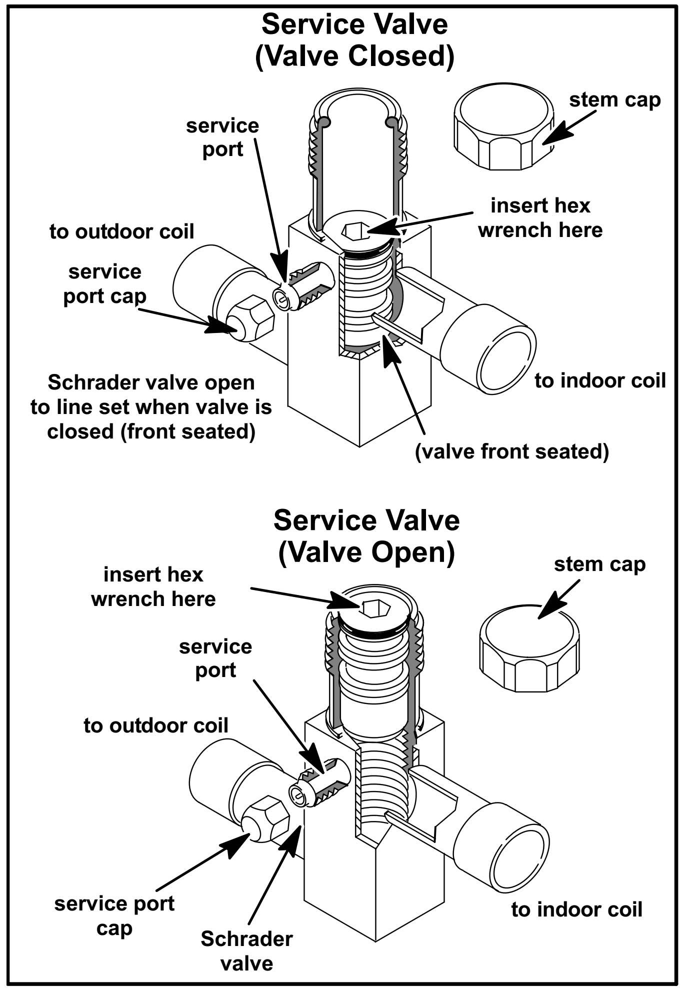


FIGURE 13

Vapor Line Ball Valve – 5 Ton Only

Vapor line service valves function the same way as the other valves, the difference is in the construction. If a valve has failed, you must replace it. A ball valve is illustrated in figure 14.

The ball valve is equipped with a service port with a factory-installed Schrader valve. A service port cap protects the Schrader valve from contamination and assures a leak-free seal.

Ball Valve (Valve Open)

Use Adjustable Wrench
To open: rotate Stem Clockwise 90°.
To close: rotate Stem Counter-clockwise 90°.

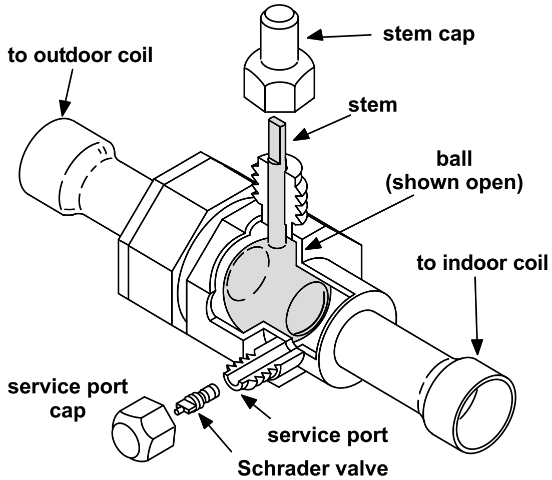


FIGURE 14

IV - CHARGING

A - Leak Testing

After the line set has been connected to the indoor and outdoor units, check the line set connections and indoor unit for leaks.

WARNING

Refrigerant can be harmful if it is inhaled. Refrigerant must be used and recovered responsibly.

Failure to follow this warning may result in personal injury or death.

WARNING

Fire, Explosion and Personal Safety Hazard.
Failure to follow this warning could result in damage, personal injury or death.
Never use oxygen to pressurize or purge refrigeration lines. Oxygen, when exposed to a spark or open flame, can cause damage by fire and / or an explosion, that can result in personal injury or death.

WARNING

Danger of explosion!
When using a high pressure gas such as dry nitrogen to pressurize a refrigerant or air conditioning system, use a regulator that can control the pressure down to 1 or 2 psig (6.9 to 13.8 kPa).

Using an Electronic Leak Detector or Halide

1 - Connect a cylinder of R-410A to the center port of the manifold gauge set.

2 - With both manifold valves closed, open the valve on the R-410A cylinder (vapor only).

3 - Open the high pressure side of the manifold to allow the R-410A into the line set and indoor unit. Weigh in a trace amount of R-410A. [A trace amount is a maximum of 2 ounces (57 g) or 3 pounds (31 kPa) pressure.] Close the valve on the R-410A cylinder and the valve on the high pressure side of the manifold gauge set. Disconnect the R-410A cylinder.

4 - Connect a cylinder of nitrogen with a pressure regulating valve to the center port of the manifold gauge set.

5 - Connect the manifold gauge set high pressure hose to the vapor valve service port. *(Normally, the high pressure hose is connected to the liquid line port; however, connecting it to the vapor port better protects the manifold gauge set from high pressure damage.)*

6 - Adjust the nitrogen pressure to 150 psig (1034 kPa). Open the valve on the high side of the manifold gauge set which will pressurize line set and indoor unit.

7 - After a few minutes, open a refrigerant port to ensure the refrigerant you added is adequate to be detected. (Amounts of refrigerant will vary with line lengths.) Check all joints for leaks. Purge nitrogen and R-410A mixture. Correct any leaks and recheck.

B - Evacuating the System

Evacuating the system of noncondensables is critical for proper operation of the unit. Noncondensables are defined as any gas that will not condense under temperatures and pressures present during operation of an air conditioning system. Noncondensables and water vapor combine with refrigerant to produce substances that corrode copper piping and compressor parts.

NOTE - This evacuation process is adequate for a new installation with clean and dry lines. If excessive moisture is present, the evacuation process may be required more than once.

⚠ IMPORTANT

Use a thermocouple or thermistor electronic vacuum gauge that is calibrated in microns. Use an instrument that reads from 50 microns to at least 10,000 microns.

1 - Connect manifold gauge set to the service valve ports :
- low pressure gauge to *vapor* line service valve
- high pressure gauge to *liquid* line service valve

2 - Connect micron gauge.

3 - Connect the vacuum pump (with vacuum gauge) to the center port of the manifold gauge set.

4 - Open both manifold valves and start the vacuum pump.

5 - Evacuate the line set and indoor unit to an **absolute pressure** of 23,000 microns (29.01 inches of mercury). During the early stages of evacuation, it is desirable to close the manifold gauge valve at least once to determine if there is a rapid rise in **absolute pressure**. A rapid rise in pressure indicates a relatively large leak. If this occurs, repeat the leak testing procedure.

*NOTE - The term **absolute pressure** means the total actual pressure within a given volume or system, above the absolute zero of pressure. Absolute pressure in a vacuum is equal to atmospheric pressure minus vacuum pressure.*

6 - When the absolute pressure reaches 23,000 microns (29.01 inches of mercury), close the manifold gauge valves, turn off the vacuum pump and disconnect the manifold gauge center port hose from vacuum pump. Attach the manifold center port hose to a nitrogen cylinder with pressure regulator set to 150 psig (1034 kPa) and purge the hose. Open the manifold gauge valves to break the vacuum in the line set and indoor unit. Close the manifold gauge valves.

⚠ CAUTION

Danger of Equipment Damage.
Avoid deep vacuum operation. Do not use compressors to evacuate a system.
Extremely low vacuums can cause internal arcing and compressor failure.
Damage caused by deep vacuum operation will void warranty.

7 - Shut off the nitrogen cylinder and remove the manifold gauge hose from the cylinder. Open the manifold gauge valves to release the nitrogen from the line set and indoor unit.

8 - Reconnect the manifold gauge to the vacuum pump, turn the pump on, and continue to evacuate the line set and indoor unit until the absolute pressure does not rise above 500 microns (29.9 inches of mercury) within a 20-minute period after shutting off the vacuum pump and closing the manifold gauge valves.

9 - When the absolute pressure requirement above has been met, disconnect the manifold hose from the vacuum pump and connect it to an upright cylinder of R-410A refrigerant. Open the manifold gauge valves to break the vacuum from 1 to 2 psig positive pressure in the line set and indoor unit. Close manifold gauge valves and shut off the R-410A cylinder and remove the manifold gauge set.

C - Charging

Charge Using the Weigh-in Method—*Outdoor Temperature < 65ºF (18ºC)*

If the system is void of refrigerant, or if the outdoor ambient temperature is cool, first, locate and repair any leaks and then weigh in the refrigerant charge into the unit.

1. Recover the refrigerant from the unit.
2. Conduct leak check; evacuate as previously outlined.
3. Weigh in the unit nameplate charge. If weighing facilities are not available or if charging the unit during warm weather, use one of the following procedures.

Charge Using the Subcooling Method—*Outdoor Temperature ≤ 65ºF (18ºC)*

When the outdoor ambient temperature is below 65°F (18°C), use the subcooling method to charge the unit. If necessary, restrict the air flow through the outdoor coil to achieve pressures in the 325-375 psig (2240-2585 kPa) range. These higher pressures are necessary for checking the charge. Block equal sections of air intake panels and move obstructions sideways until the liquid pressure is in the 325-375 psig (2240-2585 kPa) range. See figure 15.

Blocking Outdoor Coil

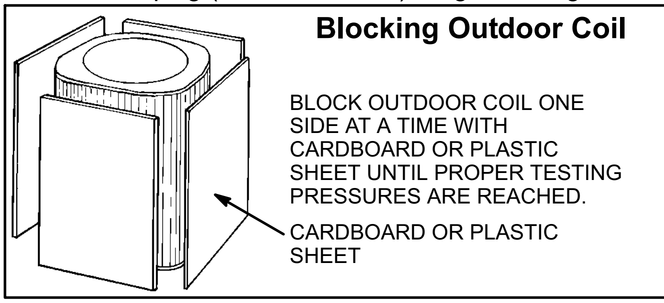


FIGURE 15

1. With the manifold gauge hose still on the liquid service port and the unit operating stably, use a digital thermometer to check the liquid line temperature and record in table 5.
2. At the same time, record the liquid line pressure reading.
3. Use a temperature/pressure chart for R-410A (table 4) to determine the saturation temperature for the liquid line pressure reading; record in table 5.

TABLE 4

R-410A Temperature (°F) - Pressure (Psig)							
°F	Psig	°F	Psig	°F	Psig	°F	Psig
32	100.8	63	178.5	94	290.8	125	445.9
33	102.9	64	181.6	95	295.1	126	451.8
34	105.0	65	184.3	96	299.4	127	457.6
35	107.1	66	187.7	97	303.8	128	463.5
36	109.2	67	190.9	98	308.2	129	469.5
37	111.4	68	194.1	99	312.7	130	475.6
38	113.6	69	197.3	100	317.2	131	481.6
39	115.8	70	200.6	101	321.8	132	487.8
40	118.0	71	203.9	102	326.4	133	494.0
41	120.3	72	207.2	103	331.0	134	500.2
42	122.6	73	210.6	104	335.7	135	506.5
43	125.0	74	214.0	105	340.5	136	512.9
44	127.3	75	217.4	106	345.3	137	519.3
45	129.7	76	220.9	107	350.1	138	525.8
46	132.2	77	224.4	108	355.0	139	532.4
47	134.6	78	228.0	109	360.0	140	539.0
48	137.1	79	231.6	110	365.0	141	545.6
49	139.6	80	235.3	111	370.0	142	552.3
50	142.2	81	239.0	112	375.1	143	559.1
51	144.8	82	242.7	113	380.2	144	565.9
52	147.4	83	246.5	114	385.4	145	572.8
53	150.1	84	250.3	115	390.7	146	579.8
54	152.8	85	254.1	116	396.0	147	586.8
55	155.5	86	258.0	117	401.3	148	593.8
56	158.2	87	262.0	118	406.7	149	601.0
57	161.0	88	266.0	119	412.2	150	608.1
58	163.9	89	270.0	120	417.7	151	615.4
59	166.7	90	274.1	121	423.2	152	622.7
60	169.6	91	278.2	122	428.8	153	630.1
61	172.6	92	282.3	123	434.5	154	637.5
62	175.4	93	286.5	124	440.2	155	645.0

4. Subtract the liquid line temperature from the saturation temperature (according to the chart) to determine the subcooling value.
5. Compare the subcooling value with those in table 5. If subcooling value is greater than shown, recover some refrigerant; if less, add some refrigerant.

TABLE 5

XP13 Subcooling Values for Charging								
____° **Saturation Temperature** — ____° **Liquid Line Temperature** = ____° **Subcooling Value**								
Model	**-018**	**-024**	**-030**	**-036**	-037	**-042**	**-048**	**-060**
°F (°C)*	6 (3.3)	3 (1.7)	7 (3.9)	4 (2.2)	4 (2.2)	5 (2.8)	7 (3.9)	7 (3.9)
***F: +/-1.0°; C: +/-0.5°**								

Charge Using the Approach Method—*Outdoor Temperature ≥ 65ºF (18ºC)*

The following procedure is intended as a general guide and is for use on expansion valve systems only. For best results, indoor temperature should be 70°F (21°C) to 80°F (26°C). Monitor system pressures while charging.

1. Check the outdoor ambient temperature using a digital thermometer and record in table 6.
2. Attach high pressure gauge set and operate unit for several minutes to allow system pressures to stabilize.
3. Compare stabilized pressures with those provided in table 7, “Normal Operating Pressures.” Minor variations in these pressures may be expected due to differences in installations. Significant differences could mean that the system is not properly charged or that a problem exists with some component in the system. Pressures higher than those listed indicate that the system is overcharged. Pressures lower than those listed indicate that the system is undercharged. Continue to check adjusted charge using approach values.
4. Use the same digital thermometer used to check outdoor ambient temperature to check liquid line temperature and record in table 6. Verify the unit charge using the approach method. The difference between the ambient and liquid temperatures should match values given in table 6. Add refrigerant to lower the approach temperature and remove it to increase the approach temperature. Loss of charge results in low capacity and efficiency.
5. If the values do not agree with those in table 6, add refrigerant to lower the approach temperature or recover refrigerant from the system to increase the approach temperature.

TABLE 6

XP13 Approach Values for Charging								
____° **Liquid Line Temperature** — ____° **Outdoor Temperature** = ____° **Approach Temperature**								
Model	**-018**	**-024**	**-030**	**-036**	-037	**-042**	**-048**	**-060**
°F (°C)*	7 (3.9)	11 (6)	11 (6)	15 (8.3)	12 (6.7)	11 (6)	9 (5)	12 (6.7)
NOTE - For best results, use the same electronic thermometer to check both outdoor-ambient and liquid-line temperatures. ***F: +/-1.0°; C: +/-0.5°**								

TABLE 7

XP13 Normal Operating Pressures									
Model	**-018**	**-024**	**-024-2**	**-030**	**-036**	**-037**	**-042**	**-048**	**-060**
Values below are typical pressures; indoor unit match up, indoor air quality equipment, and indoor load will cause the pressures to vary.									
Temp ºF (ºC)*	**Liquid Line Pressure / Vapor Line Pressure**								
Cooling Operation									
65 (18)	228 / 140	232 / 139	240 / 139	245 / 135	251 / 134	237 / 126	239 / 135	244 / 139	248 / 129
75 (24)	265 / 142	268 / 142	277 / 142	284 / 137	292 / 138	276 / 135	277 / 136	283 / 141	289 / 131
85 (29)	311 / 144	317 / 144	319 / 142	328 / 140	339 / 140	320 / 139	321 / 139	318 / 143	336 / 132
95 (35)	350 / 147	366 / 146	362 / 143	377 / 144	392 / 143	370 / 143	379 / 142	369 / 145	385 / 133
105 (41)	402 / 149	412 / 148	419 / 146	429 / 145	443 / 145	423 / 146	423 / 144	420 / 148	440 / 136
115 (45)	458 / 152	464 / 152	474 / 153	486 / 147	508 / 149	486 / 148	484 / 147	484 / 150	500 / 140
Heating Operation									
20 (-7)	278 / 67	267 / 55	285 / 61	278 / 55	285 / 57	316 / 57	309 / 60	277 / 59	305 / 59
30 (-1)	294 / 81	283 / 72	300 / 75	294 / 72	295 / 77	331 / 73	325 / 74	291 / 73	317 / 72
40 (4.5)	310 / 96	299 / 89	312 / 92	307 / 88	304 / 96	342 / 90	336 / 89	294 / 92	328 / 85
50 (10)	328 / 116	315 / 109	329 / 110	324 / 107	331 / 106	355 / 109	355 / 107	323 / 106	348 / 105
60 (16)	350 / 135	331 / 130	342 / 125	341 / 126	361 / 112	376 / 118	376 / 118	350 / 124	370 / 127
***Temperature of the air entering the outdoor coil.**									

V - SERVICE AND RECOVERY

⚠WARNING

Polyol ester (POE) oils used with R-410A refrigerant absorb moisture very quickly. It is very important that the refrigerant system be kept closed as much as possible. DO NOT remove line set caps or service valve stub caps until you are ready to make connections.

⚠ IMPORTANT

Use recovery machine rated for R410 refrigerant.

If the XP13 system must be opened for any kind of service, such as compressor or drier replacement, you must take extra precautions to prevent moisture from entering the system. The following steps will help to minimize the amount of moisture that enters the system during recovery of R-410A.

1 - Use a regulator-equipped nitrogen cylinder to break the system vacuum. Do not exceed 5 psi. The dry nitrogen will fill the system, and will help purge any moisture.
2 - Remove the faulty component and quickly seal the system (using tape or some other means) to prevent additional moisture from entering the system.
3 - Do not remove the tape until you are ready to install new component. Quickly install the replacement component.
4 - Evacuate the system to remove any moisture and other non-condensables.

The XP13 system MUST be checked for moisture any time the sealed system is opened.

Any moisture not absorbed by the polyol ester oil can be removed by triple evacuation. Moisture that has been absorbed by the compressor oil can be removed by replacing the drier.

⚠ IMPORTANT

Evacuation of system only will not remove moisture from oil. Drier must be replaced to eliminate moisture from POE oil.

VI - MAINTENANCE

In order to maintain the warranty on this equipment, the XP13 system must be serviced annually and a record of service maintained. The following should be checked between annual maintenance:

A - Outdoor Unit

1 - Clean and inspect the outdoor coil. The coil may be flushed with a water hose. Ensure the power is turned off before you clean the coil.

2 - Condenser fan motor is prelubricated and sealed. No further lubrication is needed.

3 - Visually inspect connecting lines and coils for evidence of oil leaks.

4 - Check wiring for loose connections.

5 - Check for correct voltage at unit (unit operating).

6 - Check amp-draw condenser fan motor.
Unit nameplate _________ Actual ____________ .

NOTE - If owner complains of insufficient cooling, the unit should be gauged and refrigerant charge checked. Refer to section on refrigerant charging in this instruction.

1 - Clean and inspect condenser coil. (Coil may be flushed with a water hose after disconnecting power).

2 - Visually inspect all connecting lines, joints and coils for evidence of oil leaks.

B - Indoor Coil

1 - Clean coil, if necessary.

2 - Check connecting lines and coils for evidence of oil leaks.

3 - Check the condensate line and clean it if necessary.

C - Indoor Unit

1 - Clean or change filters.

2 - Adjust blower speed for cooling. Measure the pressure drop over the coil to determine the correct blower CFM. Refer to the unit information service manual for pressure drop tables and procedure.

3 - *Belt Drive Blowers* - Check belt for wear and proper tension.

4 - Check all wiring for loose connections

5 - Check for correct voltage at unit (blower operating).

6 - Check amp-draw on blower motor
Unit nameplate_________ Actual ____________.

VII - BRAZING

Before brazing remove access panels and any piping panels to avoid burning off paint. Be aware of any components ie, service valves, reversing valve, pressure switches that may be damaged due to brazing heat.

When making line set connections, use 1 to 2 psig dry nitrogen to purge the refrigerant piping. This will help to prevent oxidation into the system.

⚠WARNING

Danger of explosion: Can cause equipment damage, injury or death. When using a high pressure gas such as dry nitrogen to pressurize a refrigeration or air conditioning system, use a regulator that can control the pressure down to 1 or 2 psig (6.9 to 13.8 kPa).

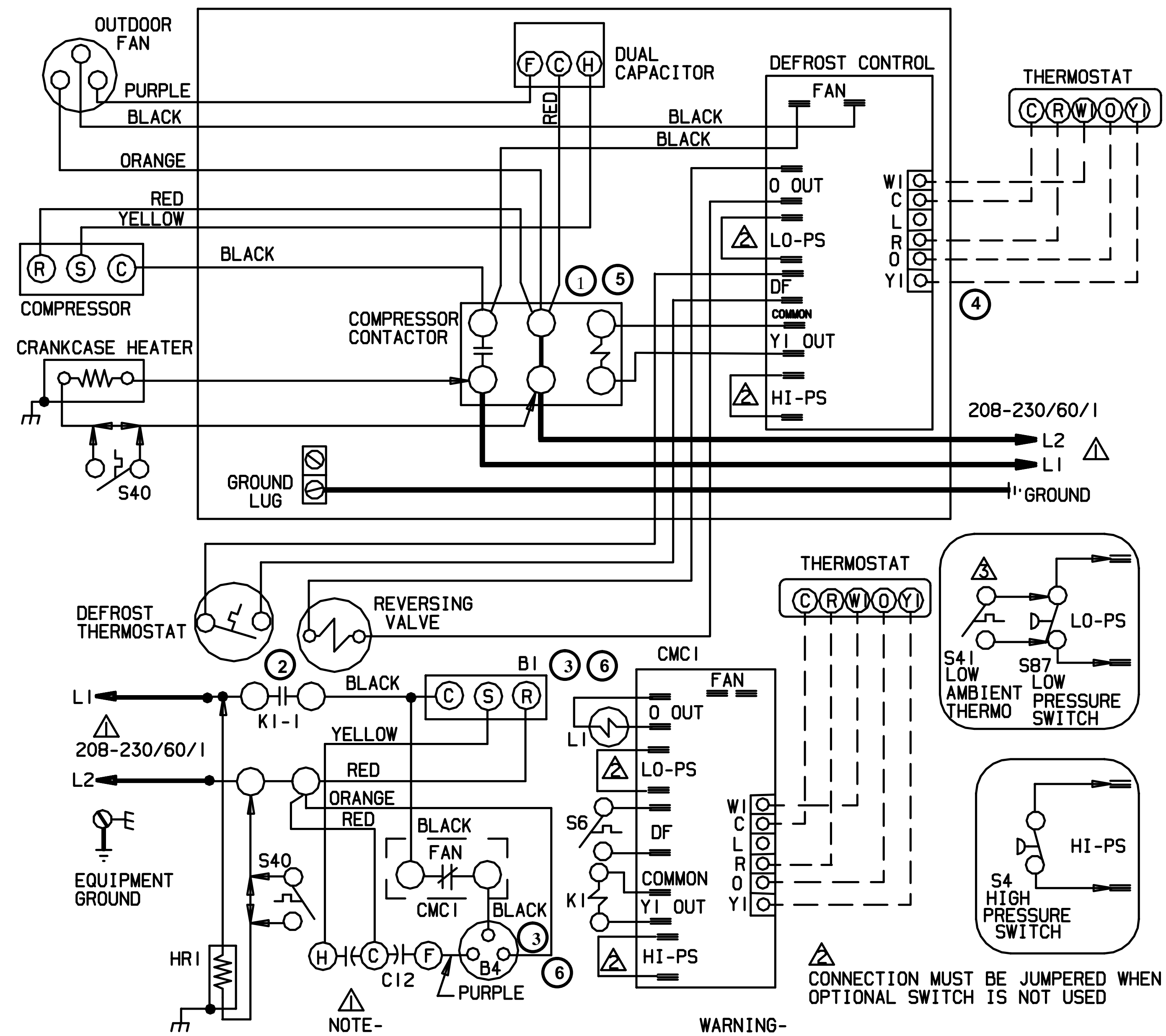
1 - .Cut ends of copper square (free from nicks or dents). Debur the ends. The pipe must remain round, do not pinch end of line.

2 - Wrap wet rag around any components that may be damaged.

3 - Use silver alloy brazing rods (5 or 6 percent minimum silver alloy for copper to copper brazing or 45 percent silver alloy for copper to brass or copper to steel brazing) which are rated for use with R-22 and R-410A refrigerant.

4 - After brazing quench the joints with a wet rag to prevent possible heat damage to any components.

VIII - WIRING DIAGRAM AND SEQUENCE OF OPERATION



DESCRIPTION	
KEY	COMPONENT
B1	COMPRESSOR
B4	MOTOR-OUTDOOR FAN
C12	CAPACITOR- DUAL
CMC1	CONTROL-DEFROST
HR1	HEATER-COMPRESSOR
K1,-1	CONTACTOR-COMPRESSOR
L1	VALVE-REVERSING
S4	SWITCH-HIGH PRESSURE
S6	SWITCH-DEFROST
S40	THERMOSTAT-CRANKCASE
S41	THERMOSTAT-LOW AMBIENT
S87	SWITCH-LOW PRESSURE

NOTE-
FOR USE WITH COPPER CONDUCTORS ONLY. REFER TO UNIT RATING PLATE FOR MINIMUM CIRCUIT AMPACITY AND MAXIMUM OVER-CURRENT PROTECTION SIZE.

S41 TO BE MOUNTED IN CONTROL BOX AND WIRED IN PARALLEL WITH LOW PRESSURE SWITCH

WARNING-
ELECTRIC SHOCK HAZARD, CAN CAUSE INJURY OR DEATH. UNIT MUST BE GROUNDED IN ACCORDANCE WITH NATIONAL AND LOCAL CODES.

DENOTES OPTIONAL COMPONENTS
LINE VOLTAGE FIELD INSTALLED
CLASS II VOLTAGE FIELD INSTALLED

	Supersedes Form No.
09/05	
	New Form No. 534,774W

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XP13 OPERATING SEQUENCE

This is the sequence of operation for XP13 series units. The sequence is outlined by numbered steps which correspond to circled numbers on the adjacent diagram.

NOTE- The thermostat used may be electromechanical or electronic.

NOTE- Transformer in indoor unit supplies power (24 VAC) to the thermostat and outdoor unit controls.

COOLING:

Indoor room thermostat wiring energizes terminal O by cooling mode selection, energizing the reversing valve L1. Cooling demand initiates at Y1 in the thermostat.

1 - 24VAC energizes compressor contactor K1.

2 - K1-1 N.O. closes, energizing compressor (B1) and outdoor fan motor (B4).

3 - Compressor (B1) and outdoor fan motor (B4) begin immediate operation.

END OF COOLING DEMAND:

4 - Cooling demand is satisfied. Terminal Y1 is de-energized.

5 - Compressor contactor K1 is de-energized.

6 - K1-1 opens and compressor (B1) and outdoor fan motor (B4) are de-energized and stop immediately.

Terminal O is de-energized when indoor room thermostat is out of cooling mode, de-energizing the reversing valve L1.

Heating demand initiates at Y1 in the thermostat.

FIRST STAGE HEATING:

See steps 1, 2 and 3.

END OF HEATING DEMAND:

See steps 4, 5, and 6.

DEFROST MODE:

7 - When a defrost cycle is initiated, the control energizes the reversing valve solenoid and turns off the condenser fan. The control will also put 24VAC on the "W1" (auxiliary heat) line. The unit will stay in this mode until either the defrost thermostat (S6) temperature is above the termination temperature of 70°, the defrost time of 14 minutes has been completed, or the room thermostat demand cycle has been satisfied. If the room thermostat demand cycle terminates the cycle, the defrost cycle will be held until the next room thermostat demand cycle. If the defrost thermostat (S6) temperature is still below the termination temperature, the control will continue the defrost cycle until the cycle is terminated in one of the methods mentioned above.